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# Facility Investigation Workplan

Cedar Chemical Corporation Facility  
Helena - West Helena, Arkansas

*Prepared for:*

**Exxon Mobil Corporation and Helena Chemical Company**

January 2008

Project No. 13636



**Geomatrix**



# State of Arkansas

## BOARD OF REGISTRATION FOR PROFESSIONAL GEOLOGISTS

3815 West Roosevelt Road  
Little Rock, Arkansas 72204

December 19, 2007

Kelly A. Beck  
Geomatrix Consultants, Inc.  
5725 Hwy 290 West, Ste. 200B  
Austin, TX 78735

Dear Applicant:

At the December 12, 2007 meeting, the Board accepted your application to work in Arkansas utilizing a temporary permit. Please verify the information contained on the enclosed permit. Return the entire permit with the required fee of \$500.00. Upon receipt, the permit will be signed and stamped. Your copy of the embossed permit will be returned to you. Please carry the permit with you at all times while working in Arkansas.

This permit will only be valid for the project(s) described in your application. If for any reason you are required to change locations or perform work not included in that application, you should notify this office immediately.

If you have any further questions, please feel free to call our office.

Sincerely,

A handwritten signature in blue ink that reads "Connie Raper". The signature is fluid and cursive, with the first name "Connie" being more prominent than the last name "Raper".

Connie Raper  
Business Controller



Board of Registration for Professional Geologists  
Temporary Work Permit

No. 4

Geologist Name: Kelly A. Beck

Company: Geomatrix Consultants, Inc.

Address: 5725 Hwy 290 West, Ste. 200B  
Austin, TX 78735

Location of Project: West Helena

Description of Work: Soil and groundwater investigation  
(Chemical Plant)

I agree to abide by the Rules and Regulations and the Code of Ethics of the Arkansas State Board of Registration for Professional Geologists. I understand that I am subject to the penalties and/or fines as prescribed by law if found to be in violation.

Applicant's Signature: Kelly Beck Date: 01/22/08

Approved: Connie Raper Date: 01/25/08

This permit valid from: January 6, 2008 To: September 30, 2008  
Begin Date End Date

**Note:** This permit is not valid unless it contains the approved seal of the Board of Registration for Professional Geologists embossed below.

Geologist Copy



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# **Facility Investigation Workplan**

Cedar Chemical Corporation Facility

Helena - West Helena, Arkansas

*Prepared for:*

**Exxon Mobil Corporation and Helena Chemical Company**

*Prepared by:*

**Geomatrix Consultants, Inc.**

5725 Highway. 290 West, Suite 200B

Austin, Texas 78735

January 2008

Project No. 13636



**Geomatrix**

**FACILITY INVESTIGATION WORKPLAN**  
**CEDAR CHEMICAL COMPANY, HELENA -WEST HELENA, ARKANSAS**

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# **FACILITY INVESTIGATION WORKPLAN**

## **CEDAR CHEMICAL COMPANY, HELENA -WEST HELENA, ARKANSAS**

### **1.0 INTRODUCTION**

On March 22, 2007, the Arkansas Department of Environmental Quality (ADEQ) issued a Consent Administrative Order (CAO) to Ansul Incorporated, formerly known as Wormald US, Inc., Helena Chemical Company, and Exxon Mobil Chemical Co., a division of Exxon Mobil Corporation, pursuant to the authority of the Arkansas Remedial Action Trust Fund Act (“RATFA”). The subject of the CAO is Cedar Chemical Corporation (“the Facility”) located in Helena-West Helena, Phillips County, Arkansas. Pursuant to Paragraph V. 20 of the CAO, ADEQ, Helena Chemical Company, and Exxon Mobil Chemical Co. entered into a separate agreement which provides that further site investigation should be performed.

On November 16, 2007, a Current Conditions Report (CCR) was submitted to ADEQ on behalf of Exxon Mobil Chemical Co. and Helena Chemical Company, which comprise the current membership of the Cedar Chemical Corporation Site Joint Defense Group (“the Group”). An electronic copy of this CCR has been provided for reference with this Facility Investigation Workplan (FI Workplan). This CCR was prepared to compile existing and available information concerning the Facility, its setting, and known impacts to environmental media. Although extensive investigative work has previously been performed at the site, and the overall character and extent of environmental impact is generally understood, the CCR concluded that the on-site and off-site extents of impact to soil and groundwater have not been completely delineated, on-site source areas have not been fully characterized, and that additional information is needed to support effective remedy selection. Geomatrix Consultants, Inc., (Geomatrix) has prepared this FI Workplan to address the supplemental data needs.

In summary the data needs, and the work planned to address these, are as follows:

- Perched Zone Hydrogeology – extent and thickness, seasonal variability, groundwater flow velocity, and hydraulic conductivity. Address through:
  - Monitoring well installation in the perched zone using rotasonic drilling methods, water level measurements, and aquifer testing.
- Alluvial Aquifer Hydrogeology –groundwater flow velocity, hydraulic conductivity, presence of highly transmissive natural features, and basic geochemical properties of the alluvial aquifer. Address through:
  - Cone penetrometer testing (CPT), monitoring well installation using rotasonic drilling methods, water level measurements, and aquifer testing.

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- Chemical Impact to Perched Zone and Alluvial Aquifer Groundwater – further assessment of the source, character, and extent of chemical impact in the two groundwater zones. Address through:
  - Groundwater sampling and analysis of new and existing wells for constituents of concern (COCs).
- Waste Disposal Areas – further delineation of the extent of waste remaining on site that may be behaving as a source of groundwater contamination and of current concentrations in soil and groundwater adjacent to waste disposal areas. Address through:
  - Soil borings advanced using direct-push technology (DPT), soil sampling, field screening and analysis for COCs.
- Exposure Pathways – potential for the current or future groundwater use within and near to COC groundwater plumes. Address through:
  - Confirmation of residential and agricultural well survey, update the understanding of land use in site vicinity.

These activities are described in greater detail in Section 3 of this FI Workplan. Various figures showing the locations of soil borings to evaluate the contaminants at the former dinoseb disposal ponds, process areas, the drum vault, and wells for the perched zone extent investigation are included in this workplan.

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### **2.0 SITE DESCRIPTION**

A full site description was presented in the November 2007 CCR. A brief summary of this information is provided below.

#### **2.1 SITE LOCATION AND SETTING**

The former Cedar Chemical Corporation (CCC) Helena-West Helena Plant is located just to the south of the city of Helena-West Helena, in Phillips County, Arkansas. The Facility consists of approximately 48 acres located within the Helena-West Helena Industrial Park, approximately 1.25 miles southwest of the intersection of U.S. Highway 49 and State Highway 242. A site location map is included as Figure 1.

The former operational portion of the property is divided into two major areas: (1) the manufacturing area, to the north of Industrial Park Road, and (2) the wastewater treatment system area, to the south of Industrial Park Road. Of the 48 acres, approximately 40 acres comprise the former manufacturing area of the facility, and are fenced. The remaining 8 acres contain the wastewater treatment ponds.

#### **2.2 PHYSIOGRAPHY AND TOPOGRAPHY**

The topography of the terrain at the site and surrounding area is relatively flat, with some areas sloping gently toward the southeast. The Facility is located on a gentle drainage divide; to the north and west, regional surface water flow is generally southwest, connecting through a series of ditches, creeks, and bayous to the White River approximately 50 miles to the southwest. To the south and east, regional surface water flow is generally toward the Mississippi River.

#### **2.3 GEOLOGY AND HYDROGEOLOGY**

The shallow geology of the Site comprises approximately 150 feet of alluvium overlying a thick sequence of clays (the Jackson Group). The clays of the Jackson Group are approximately 250 feet thick in this area, and comprise a regional confining layer over the Sparta Sand aquifer.

Geologic cross sections were developed for the Site; their locations are shown in Figure 2, and the cross sections are shown in Figures 3 and 4. A 1993 Facility Investigation identified five stratigraphic units within the Quaternary alluvium and underlying clay at the site (EnSafe, 1996(a)).

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1. Unit 1 extends from ground surface to approximately 32 feet below ground surface (bgs) and consists of silts, clays and sands. Unit 1 includes a perched groundwater-bearing zone referred to as the perched zone.
2. Unit 2 extends from approximately 32 to 47 feet bgs, and consists of clays and silts. Unit 2 is referred to as the semi-confining unit.
3. Unit 3 extends from 47 to 116 feet bgs, and consists of a sand and gravel sequence that coarsens with depth and clay stringers. Unit 3 corresponds to the upper portion of the alluvial aquifer.
4. Unit 4 extends from 116 to 131 feet bgs, and consists of clay. Unit 4 is the middle section of the alluvial aquifer.
5. Unit 5 extends from 131 to 152 feet bgs, and consists of sand and gravel. Unit 5 is the lower section of the alluvial aquifer, and overlies the regional confining layer (Jackson Clay).

Two groundwater regimes exist at the site: a discontinuous perched zone in the Unit 1 silt and clay surficial sediments (ground surface to 32 feet bgs) and the alluvial aquifer. The alluvial aquifer, as discussed above, consists of an upper unit (Unit 3 from the discussion above) at approximately 47 to 116 feet bgs, and a lower unit (Unit 5) at approximately 131 to 152 feet bgs. The two are separated by a silty clay stratum (Unit 4). Locally, the alluvial aquifer appears to be confined by the upper 40 feet of silt and clays (Units 1 and 2). The alluvial aquifer overlies the Jackson Group stratum of clay and lignite materials at approximately 150 feet bgs.

### **2.4 SITE HISTORY**

Prior to 1970, the land where the site now exists was used for agriculture purposes (EnSafe, 1996). The plant was constructed in the early 1970s, and operated by a number of parties until its closure under bankruptcy in 2002. ADEQ assumed control of the site on October 12, 2002.

During its operational life, the Facility manufactured various agricultural chemicals, including insecticides, herbicides, polymers, and organic intermediates. Plant processes were batch operations, with seasonal production fluctuations and the frequent introduction of new products. The plant also produced a variety of chemicals on a toll manufacturing basis for a number of customers.

Several previous investigations of the Site were completed between 1985 and 2002. These investigations are documented in previous reports and outlined in detail in the CCR (Geomatrix, 2007).

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### **3.0 FIELD INVESTIGATION APPROACH**

The following sections describe the investigation procedures that will be followed by field personnel during the implementation of the FI Workplan. Sampling and investigation procedures will follow currently accepted industry-standard practices and applicable regulatory guidance; selected specific procedures are described in detail below or in the Quality Assurance Project Plan (QAPP) located in Appendix A. The QAPP provides detailed information on the project description, project organization and responsibility, data quality assurance objectives, field sampling plans, sample custody procedures, field equipment calibration procedures, analytical procedures, and data validation and reporting. All Geomatrix field activities will also be performed pursuant to the Project Health and Safety Plan, included as Appendix B of this FI Work Plan.

#### **3.1 PERCHED ZONE WELL INSTALLATION**

Figure 5 shows the estimated extent of the perched zone based on historical data. Additional wells will be installed in the perched zone at the locations shown in Figure 5 to further delineate the extent and continuity of this zone. Additional locations may be added, at the discretion of the Geomatrix Project Manager, based on initial drilling results. Initial drilling results (for example, a dry well) may also suggest that a proposed well location is not suitable to address the investigation objectives. In this event, field personnel may elect not to install a well at a location shown on Figure 5, with the approval of the Geomatrix Project Manager, in consultation with the ADEQ Project Manager.

A typical well construction diagram for the perched zone wells is included as Figure 6. Although final drilling and construction details may be modified to account for observed conditions in the field, the anticipated general approach is as follows:

- Rotasonic drilling techniques will be used for drilling and well installation. This method generates a relatively continuous soil core as the drive casing is advanced.
- The soil core will be field screened and logged by an on-site field geologist. Screening will consist of chemical odors, or organic vapors. This will also include a headspace check using a field organic vapor meter. At least one sample from each 10-foot interval will undergo a headspace examination.
- If gross contamination, such as non-aqueous phase liquid (NAPL) or waste is encountered, a sample of this material will be retained for off-site analysis. Otherwise, soil samples from these borings will not be retained.

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- The well will be constructed within the rotasonic drive casing. The filter pack and bentonite seal will be surface poured into the casing in increments, as the casing is gradually withdrawn. The depth to these materials will be regularly sounded with a weighted measuring tape as the casing is withdrawn.
- The base of the screen will be placed at approximately the upper surface of the Unit 2 clay confining layer. This is anticipated to be at a depth of approximately 30 to 35 feet below ground surface (bgs).
- After the bentonite seal has hydrated, the remaining annular space will be sealed with a cement-bentonite grout mix. Unless the annulus is dry, the grout will be placed through a tremie pipe; the discharge of this tremie pipe will be placed approximately two feet above the top of the bentonite seal. Grout returns will be observed, and the density of these returns must be within 10 percent of the original grout density before grouting is terminated. A sample of grout will be retained for each well.

Any boring not used for well installation will be sealed using bentonite chips or a bentonite-cement grout. Bentonite chips will only be used to seal the portion of borings within the saturated zone, or to top off the upper few feet of a grouted boring.

New and existing wells will be developed using surging, pumping, bailing, or a combination of these methods. Development will be considered complete when produced groundwater is visibly free of turbidity, and pH and specific conductance are stable within 10 percent for four consecutive casings volumes. All development water will be containerized and staged in a secure area to await characterization and disposal.

### **3.2 ALLUVIAL AQUIFER INVESTIGATION**

Additional wells will be installed in order to complete the delineation of chemical impact in the alluvial aquifer, and to further characterize the hydraulic and geochemical nature of that aquifer. The locations and anticipated depths of alluvial aquifer wells will be based on the results of the CPT investigation and the January 2008 groundwater sampling event described in Sections 3.3 and 3.7, respectively of this FI Work Plan. Proposed locations will be submitted to ADEQ after data acquisition from these two tasks has been completed. Typical well construction details for alluvial aquifer wells are shown in Figure 7. The general well installation procedures will follow those outlined in Section 3.1.

### **3.3 CONE PENETROMETER TESTING (CPT)**

A CPT investigation will be performed to identify transmissive zones that may act as preferential migration pathways in the alluvial aquifer, and to improve the geologic characterization of this

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## **CEDAR CHEMICAL COMPANY, HELENA -WEST HELENA, ARKANSAS**

aquifer. The locations of the CPT borings are presented on Figure 8. The CPT methods are described below:

- At each location, a CPT rig will be used to advance a borehole to approximately 5 feet below the base of the alluvial aquifer at an approximate depth of 152 feet bgs, or refusal, whichever is shallower. As it is advanced, the CPT will generate a continuous record of cone tip resistance and friction sleeve resistance. These will be correlated to known soil types, to generate a lithologic boring log.
- After reaching the total depth of the boring, the CPT probe will be removed and the boring will be sealed with bentonite-cement or bentonite grout.

Additional CPT borings may be added, at the discretion of the Geomatrix Project Manager, based on the findings from the CPT and other drilling work described in this FI Work Plan. At least two of the alluvial aquifer borings described in Section 3.2 of this FI Work Plan will be co-located with CPT borings, to allow confirmation of the lithologic interpretation generated from the CPT borings.

### **3.4 DIRECT PUSH BORINGS**

Soil borings will be advanced using direct push technology (DPT) at background locations, in the areas of the former dinoseb disposal ponds, the drum vault, and the process areas (including suspected waste burial pits in the process area that were identified by ADEQ). The purpose of the DPT investigation is to improve the characterization of buried wastes or contaminated soils that may be on-going sources of groundwater impact and may need to be addressed as part of a site remedy, rather than provide a detailed delineation of the vertical and horizontal extent of each constituent in site soils and groundwater. To accomplish this, Geomatrix will:

- Identify and characterize possible waste or waste constituent migration from the drum vault.
- Locate the former dinoseb disposal ponds.
- Characterize soil impact at the various process area locations and suspect waste burial locations.
- Collect grab samples of groundwater in these areas at 10 locations.
- Improve the characterization of background levels of metals, pesticides, and herbicides in surface and subsurface soils.

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The DPT boring locations are presented on Figure 9 and Figure 10 for the background locations. The DPT methodology is described below.

- DPT borings will be advanced to a depth of:
  - approximately 10 feet bgs in the area of the former dinoseb disposal ponds.
  - to approximately 5 feet into the first water-bearing zone or refusal at the periphery of the drum vault and at the process areas.
  - approximately 15 feet at the background sample locations.
- Each core will be logged and field screened in the field by the on-site field geologist as described in Section 3.1
- At the former dinoseb disposal ponds, one soil sample per boring from a nominal depth of 3 to 5 feet will be retained and analyzed for pesticides and herbicides.
- In the area of the drum vault, at least one sample per boring from a nominal depth range of 0 to 5 feet below the vault's base, as observed from the evaluation described in Section 3.5 will be retained for off-site analysis. If that evaluation does not provide an accurate measure of the vault's depth, Geomatrix may excavate in selected locations around the vault's perimeter to determine that depth. Additional samples may be retained if waste materials or other evidence of gross contamination is observed.
- At the process areas:
  - At least one sample per boring will be retained for off-site analysis, from a nominal depth range of 0 to 5 feet. Additional samples may be retained from other depths based on field observations.
  - An expanded sampling protocol will be used at three borings, which will be selected in consultation with ADEQ. Samples from these borings will be retained for analysis from 0 to 2 feet bgs and from 10 foot depth intervals beginning at 10 feet bgs until groundwater is encountered.
  - Based on observed field conditions, approximately 10 of the borings will be completed as temporary wells. These wells will consist of nominal 1-inch diameter polyvinyl chloride casing and screen. Boring locations with evidence of soil impact extending to depth will be preferentially selected for temporary well construction. After collection of a groundwater sample, each temporary well will be removed from the boring.

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- At background locations, one sample of surface (0 to 5 ft bgs) and subsurface (below 5 ft bgs) soils will be retained for analysis for pesticides/herbicides and metals.
- All DPT borings will be sealed using bentonite-cement or bentonite grout.

Additional borings may be advanced at each location at the discretion of the Geomatrix Project Manager, based on the results of this initial drilling. Also, since background boring locations are off site, their performance and schedule will be subject to access negotiation with the respective property owners.

### **3.5 DRUM VAULT INSPECTION**

Geomatrix will identify and collect available information regarding the history of the construction and contents of the drum vault from historical sources and ADEQ files. Thereafter, Geomatrix will conduct an initial field evaluation of the conditions of drums within the vault, and the floor, walls, and backfill material of the vault itself. Geomatrix anticipates this initial field evaluation will include the following:

- Nominal 1-inch diameter borings will be drilled through the concrete warehouse floor which forms the roof of vault. One boring will be drilled in each quadrant of the vault. Borings will be drilled using a dry bit and if necessary, with the addition of water to the boring, to maintain wet conditions and prevent possible sparking. If water is used suction will be applied to the bit to remove the water to prevent it from leaking into the drum vault area.
- Borings will be advanced slowly through the concrete measuring the depth as advancement occurs, to prevent the possibility of puncturing any drums that may reside directly beneath the floor area. When the borings have penetrated into the vault, drilling will be terminated, and any residual water will be removed.
- The atmosphere of the vault will be tested for explosive conditions and organic vapors at each boring location. The borings will also allow the measurement of the approximate concrete thickness.
- If measured conditions indicate the presence of a significant hazard (i.e., toxic or explosive conditions), the borings will be sealed and an alternate plan of evaluation will be developed to address these conditions.
- If no such hazard is observed, concrete will be saw-cut at each boring location, to remove a concrete slab at least approximately 4 feet square.

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- After slab removal, conditions within the vault will be visually inspected at each location, including drum construction, packing, and condition. If practicable, one or more drums may be opened or removed, and the contents inspected and sampled.
- At least one sample of the backfill material will be collected for off-site analysis at each entry location. The specific location, depth, and method of collection of these samples will be based on observed field conditions.

To the extent practicable, the condition of the floor and walls of the vault will be visually inspected at each location. Field personnel will photograph the entry and evaluation process at each location. At the conclusion of the visual inspection, the openings in the vault will be covered and sealed with a grout or similar material, pending decisions on the ultimate fate of the vault and contents. This approach may be modified or supplemented in advance of field mobilization as additional information on the vault is acquired. Any proposed modifications or additions will be provided in writing to ADEQ for approval prior to performance of the work.

### **3.6 SOIL SAMPLING**

The anticipated soil sampling program is described for each drilling method in the preceding sections. Soil samples retained for off-site analysis will be managed as described in the QAPP provided in Appendix A.

### **3.7 GROUNDWATER SAMPLING**

As discussed with ADEQ on December 4, 2007, Geomatrix and ADEQ personnel are currently performing a baseline groundwater sampling event of existing on-site wells. This event is anticipated to be completed by January 18, 2008, and will be performed pursuant to a Sampling and Analysis Plan submitted to the ADEQ in December 2007. During the sampling event an assessment of the construction of selected wells using a downhole camera will be performed for which no construction details (particularly the screened interval) are available.

The data from this event will be used to update Geomatrix's understanding of groundwater conditions, and to guide the placement of new monitoring wells in the alluvial aquifer. Upon completion of the January 2008 baseline groundwater sampling event and evaluation of the data, a Supplemental FI Workplan will be submitted to ADEQ, identifying additional monitoring well locations.

Groundwater will also be sampled at new and existing wells upon completion of the FI well installation program.

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As discussed in the QAPP, the preferred method for purging and sampling will be the low-flow (a.k.a., micopurge) approach. The methods for well measurements, purging, and sampling are discussed in the QAPP.

### 3.8 SAMPLE ANALYSIS

Samples of environmental media, including soils and groundwater, will be analyzed by an off-site laboratory certified by the State of Arkansas. The analytical methods are described in the QAPP included as Appendix A. Table 1 of the QAPP provides a Target Analyte List of individual compounds to be analyzed under each parameter group (i.e., metals, volatile organic compounds). Table 1 of this FI Workplan more specifically provides areas of investigation, media to be collected and constituents to be analyzed.

**Table 1**  
**Areas of Investigation, Media and Sample Collection Detail**

	<b>Media</b>	<b>Constituents to be Analyzed</b>	
Perched Zone Well Installation	Soil	VOCs, SVOCs, Metals, Herbicides, Pesticides	if retained
	Groundwater	VOCs, SVOCs, Metals, Herbicides, Pesticides	
Alluvial Aquifer Investigation	Soil	VOCs, SVOCs, Metals, Herbicides, Pesticides	if retained
	Groundwater	VOCs, SVOCs, Metals, Herbicides, Pesticides	
Cone Penetrometer Testing (CPT)	None	None	
Dinoseb Disposal Ponds	Soil	Pesticides and Herbicides	
Drum Vault	Soil	VOCs, SVOCs, Metals, Herbicides, Pesticides	
Process Area and Suspect Waste Disposal Areas identified by ADEQ	Soil/Groundwater	VOCs, SVOCs, Metals, Herbicides, Pesticides	
Background Locations	Soil	Pesticides and Herbicides, Metals	
Drum vault--drum contents & backfill	Solids/Backfill	To be determined	

### 3.9 LAND USE AND SUPPLY WELL SURVEY

The CCR presented information on a previous water well survey conducted in 1995 by EnSafe. Several of the residences are located within a one-mile radius of the site, primarily along Phillips County Road 300. This survey identified nineteen residences downgradient or cross-gradient from the Site with wells that formerly supplied residences with domestic water. All of the residences, however, had reportedly been connected to the city water system for over 10 years at the time of the survey.

In order to update the well survey, Geomatrix will identify all residences and businesses within one mile downgradient (southeast) of the site. A request for information on well status will be mailed to each identified residence or business. In addition, county office resources and other

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land planning maps and information as well as pertinent water user associations will be contacted for information. If a well is present, Geomatrix will request permission from the property owner to inspect and possibly sample the well. All information will be recorded in the field log book.

In addition, a current aerial photograph will be flown, encompassing the well survey discussed above, and the surrounding area to a distance of at least 0.5 miles upgradient and to either side of the site cross gradient and one mile downgradient (all distances from the site boundary) of the site. A windshield survey will be performed to update a land use description for all properties within this area.

### **3.10 WELL ABANDONMENT**

If monitoring wells are identified that are not suitable for future use, Geomatrix will propose their abandonment to ADEQ. The basis for this recommendation could be any of the following:

- Well location or depth is not likely to yield useful data.
- Well construction or condition does not meet current industry standards, and could behave as a pathway for contaminant migration into the subsurface or between water-bearing zones.
- Well construction cannot be verified.

Wells subject to this recommendation will not be sampled.

All wells will be abandoned by pulling the casing, drilling out the annular materials, and grouting the resulting borehole to comply with the ADEQ Policy #HWD-002 Monitoring Well Construction, Geotechnical Boreholes and Plug and Abandonment Policy Memorandum.

### **3.11 HISTORICAL DATA VALIDATION**

During previous investigations at the site, acetone and methylene chloride were detected in on-site soil. It is not known to what extent these constituents are actually present in soil as opposed to being a sampling or laboratory artifact. Historical data including field and laboratory methods will be reviewed and validated to assess the quality of these acetone and methylene chloride detections. Data validation will include:

- Review of the distribution of these compounds in soil samples.

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- Review of laboratory and field quality control (QC) data (e.g., the presence of these compounds in blanks) and
- If available, review of facility laboratory records to determine if the laboratory operating before the facility shutdown handled or used these compounds.

### **3.12 AQUIFER TESTING**

Aquifer testing will be performed on selected new and existing wells in both the perched and alluvial aquifers. After the installation of new wells, development, and sampling, five wells in each aquifer will be selected for step-drawdown or slug testing. Test locations will be selected by the Geomatrix Project Manager after the completion of the well installation activities. The objective of aquifer testing is to evaluate the flow regimes of both aquifers, including an evaluation of aquifer properties such as transmissivity (T), hydraulic conductivity (K), and radius of influence. Depending on the well recovery observed during the January 2008 groundwater sampling event, either a step-drawdown pumping test (if wells recover quickly) or a slug test will be performed. Aquifer test data will be analyzed by use of the mathematical methods Theis (1935), Cooper-Jacob (1946), and Bouwer & Rice (1976).

Each test method is described below.

#### **3.12.1 Step-Drawdown Testing**

The pumping phase of the step-drawdown test will consist of:

1. Initial measurements of water level in the pumping and observation wells.
2. Pumping the well at least five different rates (steps) specified by the responsible professional with an approximate duration of one hour per step. If practicable, the well will be allowed to recover to near-static conditions between steps.
3. Periodically measuring the water levels in the pumped well and observation wells, if available during each step;
4. Measuring the instantaneous and cumulative discharge from the pumped well using a flow meter or other appropriate means.

The maximum water-level drawdown will be approximately 50 percent of the available drawdown. A relatively constant pumping rate will be maintained during each step. The rate will be checked periodically and adjusted, if necessary. The accuracy of the flow meter also may be verified periodically by comparing the flow rate obtained by timing a revolution of the sweep

# **FACILITY INVESTIGATION WORKPLAN**

## **CEDAR CHEMICAL COMPANY, HELENA -WEST HELENA, ARKANSAS**

needle on the flow meter with the flow rate obtained by timing the filling of a container of known volume.

The recovery phase of the step-drawdown test will begin immediately after the pump is shut off, at the completion of the final step of the pumping phase. Recovery water-level measurements will be made periodically in the pumped well and observation wells. Water level measurements will conclude when one of the following is satisfied:

- 95 percent of the induced drawdown has recovered; or
- The water level in the pumped well has changed less than 0.05 foot for at least 2 hours.

### **3.12.2 Slug Testing**

This procedure describes the performance of slug tests for evaluating the hydraulic characteristics of the aquifer. The following procedures will be used to perform the slug test.

- The static water level will be measured in the test well. This information will input into the data logger along with the well identification, date and other information as required.
- A pressure transducer and cable will be lowered into the well to a depth of at least 10 feet below the water surface. If water levels in the well prohibit this depth of submergence, the transducer will be placed at the bottom of the well.
- The slug dimension will be measured and its volume calculated. The slug will then be placed into the well and the water level will be allowed to return to its static level.
- The slug will simultaneously be withdrawn and the data logger will be activated. Slug withdrawal will be rapid, with the slug emerging completely within 2 to 4 seconds of the test start.
- The test will be continued until the water level recovers to about 70 percent of the initial level.

### **3.13 WELL SURVEYING**

A licensed surveyor in the State of Arkansas will be retained to survey the top of casing, location and ground and elevation of each new and existing well in the monitoring network in order to obtain current coordinates that will be used to develop accurate water level measurements relative to mean sea level.

**FACILITY INVESTIGATION WORKPLAN  
CEDAR CHEMICAL COMPANY, HELENA -WEST HELENA, ARKANSAS**

**3.14 INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT**

Soil cuttings generated during the investigation will be placed into a roll-off box container pending characterization and water generated will be placed into temporary storage tanks pending characterization as hazardous vs. non-hazardous. Non-hazardous soil will be disposed of at an appropriate landfill. Non hazardous water will be transported to a Publicly Owned Treatment Works (POTW) or other properly permitted facility for treatment, recycling, or disposal. All hazardous waste will be managed and disposed according to applicable state and federal requirements, in consideration of the analytical results from the media generated during the FI.

# **FACILITY INVESTIGATION WORKPLAN**

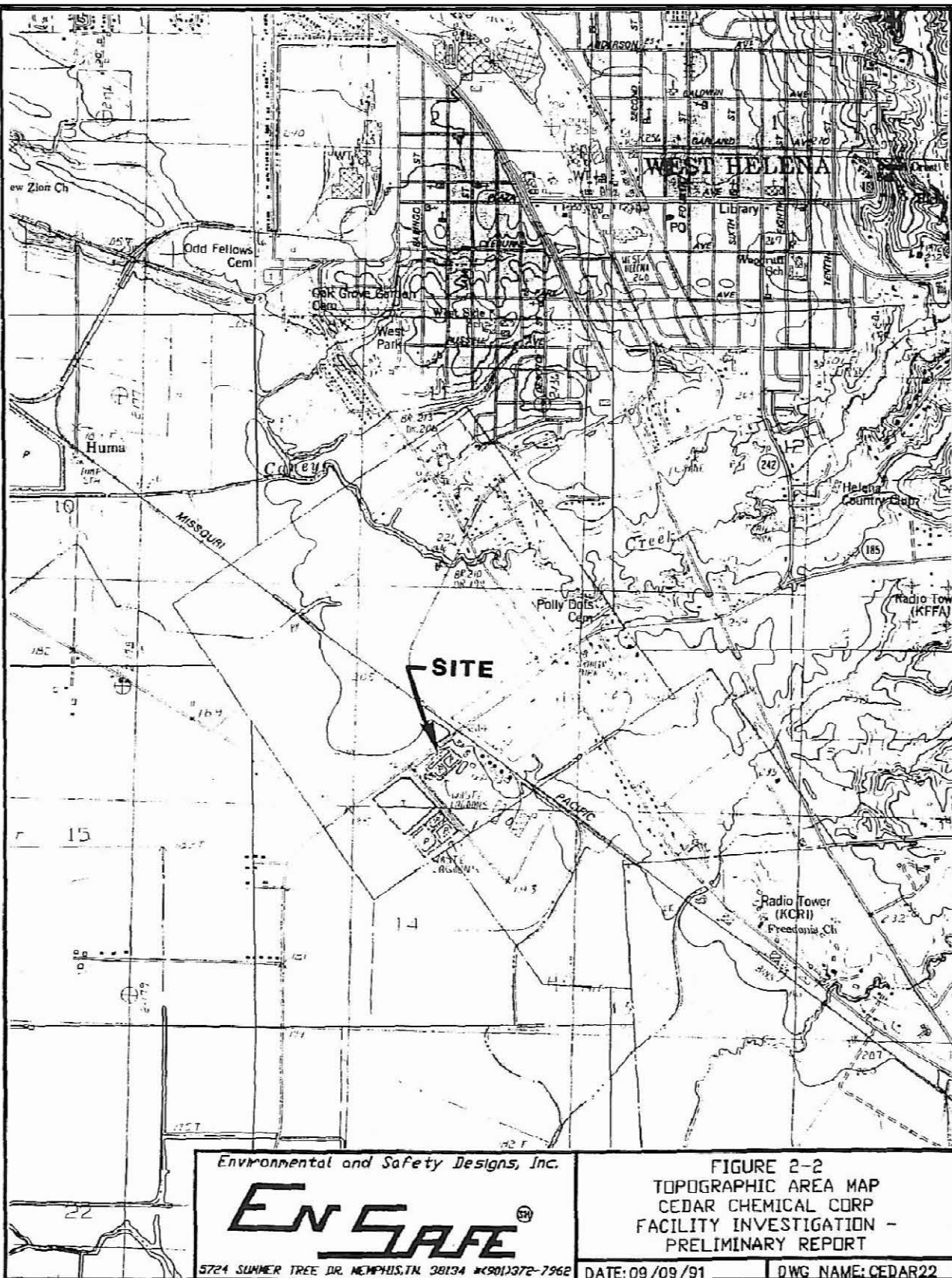
## **CEDAR CHEMICAL COMPANY, HELENA -WEST HELENA, ARKANSAS**

### **4.0 FIELD INVESTIGATION SCHEDULE**

The anticipated schedule for the project is provided below. Note that this assumes a nominal six-week ADEQ review time for this FI Workplan, and a nominal four-week review time following submittal of any supplemental workplan documents, with no substantial changes resulting from those reviews (i.e., comments can be addressed through correspondence or minor revisions). These dates are approximate and are subject to change based on field and weather conditions, acquisition of off-site access, and the actual duration of field activities. The following milestones have currently been met or are anticipated:

- Submittal of FI Work Plan to ADEQ and the completion of the baseline initial groundwater sampling event – January 18, 2008.
- ADEQ approval of FI Work Plan – within six weeks following the FI Work Plan submittal – February 26, 2008.
- Mobilization to the site to begin the field investigation – approximately two weeks following receipt of ADEQ approval of the FI Work Plan – March 24, 2008.
- Submittal of Supplemental FI Work Plan to ADEQ, with proposed alluvial aquifer well locations – approximately four weeks after field mobilization – April 11, 2008.
- ADEQ approval of Supplemental FI Work Plan – May 9, 2008.
- Completion of planned field investigation activities. Assume 12 weeks after approval of the Supplemental FI Workplan – August 1, 2008.
- Submittal of FI Investigation Report to ADEQ approximately 90 days after the completion of the field activities – October 30, 2008.

As noted above, the durations and dates after March 2008 are approximate. This performance schedule will be periodically updated as Facility Investigation activities proceed.



SOURCE: EnSafe, Phase II Investigation Report, 1995



## SITE LOCATION MAP

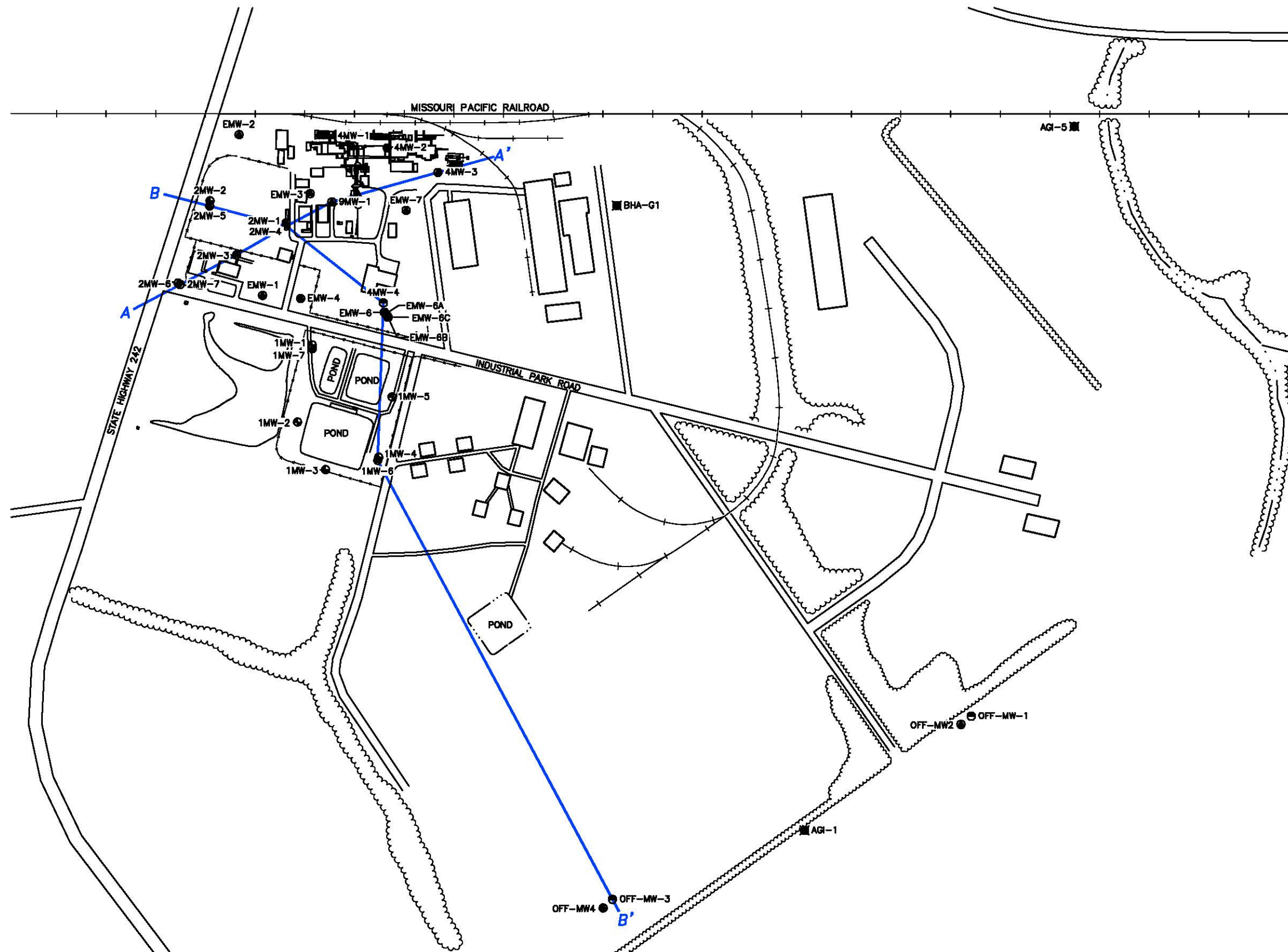
Cedar Chemical  
Helena-West Helena, Arkansas



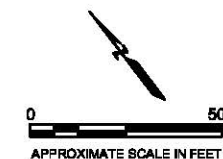
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Project 13636

Figure 1



- EXPLANATION**
- WATER OR DRAINAGE
  - ROAD
  - RAILROAD
  - BUILDING
  - FENCE
  - DEEP MONITORING WELL (LOWER ALLUVIUM)
  - SHALLOW MONITORING WELL (UPPER ALLUVIUM)
  - PERCHED ZONE MONITORING WELL
  - AGRICULTURAL IRRIGATION WELL
  - LINE OF CROSS SECTION



**FINAL**

BASE MAP MODIFIED FROM:  
EnSafe, 1996-Phase III FI, 2001 Groundwater Monitoring Report,  
Drawings C2162GWS and C2162VC7

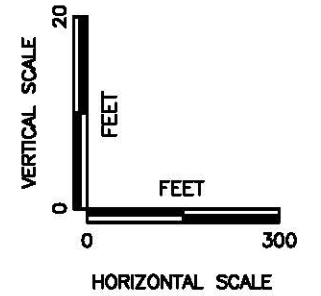
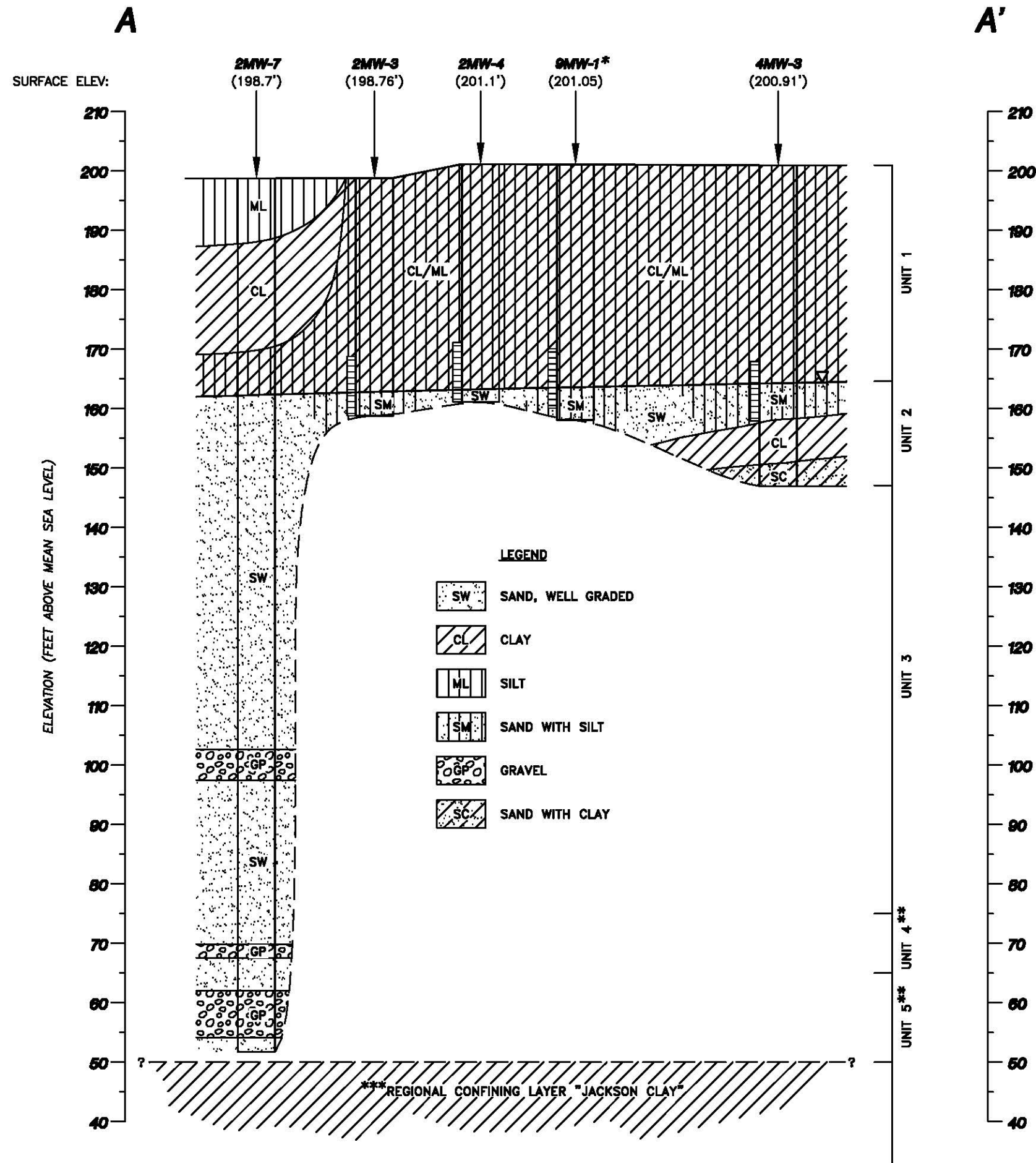
LINES OF CROSS SECTION MAP

Cedar Chemical  
Helena-West Helena, Arkansas

By: HCS Date: 1/15/08 Project No. 13636



Figure 2



#### LEGEND

- 2MW-4 MONITORING WELL
- SCREENED INTERVALS FOR LOCATIONS HAVING INSTALLED WELLS
- RELATIVE GROUNDWATER ELEVATION
- \* SURFACE ELEVATION AT THIS POINT INTERPRETED FROM TOPOGRAPHIC MAP
- \*\* UNIT NOT OBSERVED IN LITHOLOGIC SAMPLES BUT WAS IDENTIFIED IN GEOPHYSICAL LOGGING

# FINAL

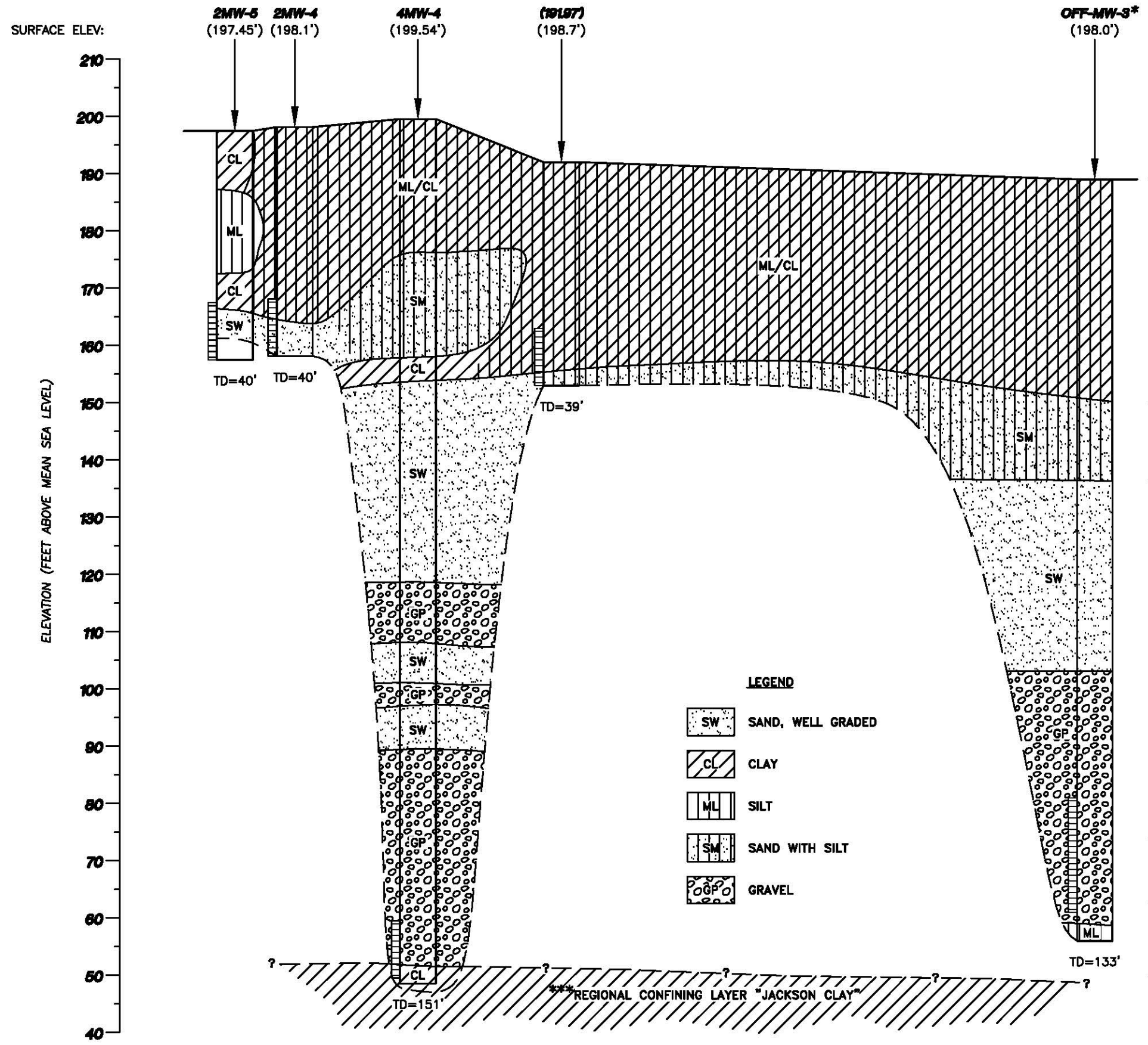
CROSS SECTION A-A'  
Cedar Chemical  
Helena-West Helena, Arkansas

By: HCS Date: 1/15/08 Project No. 13636

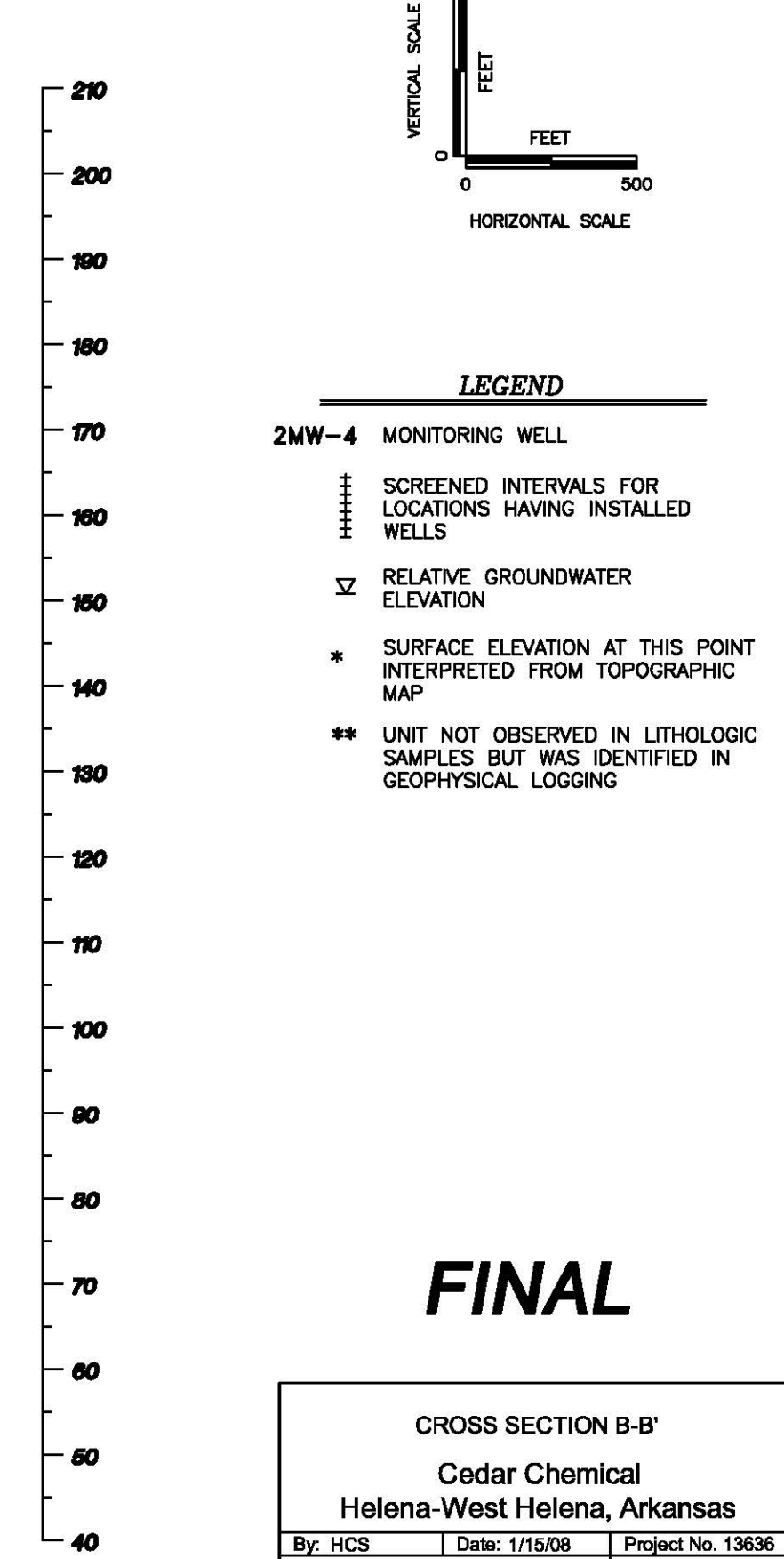


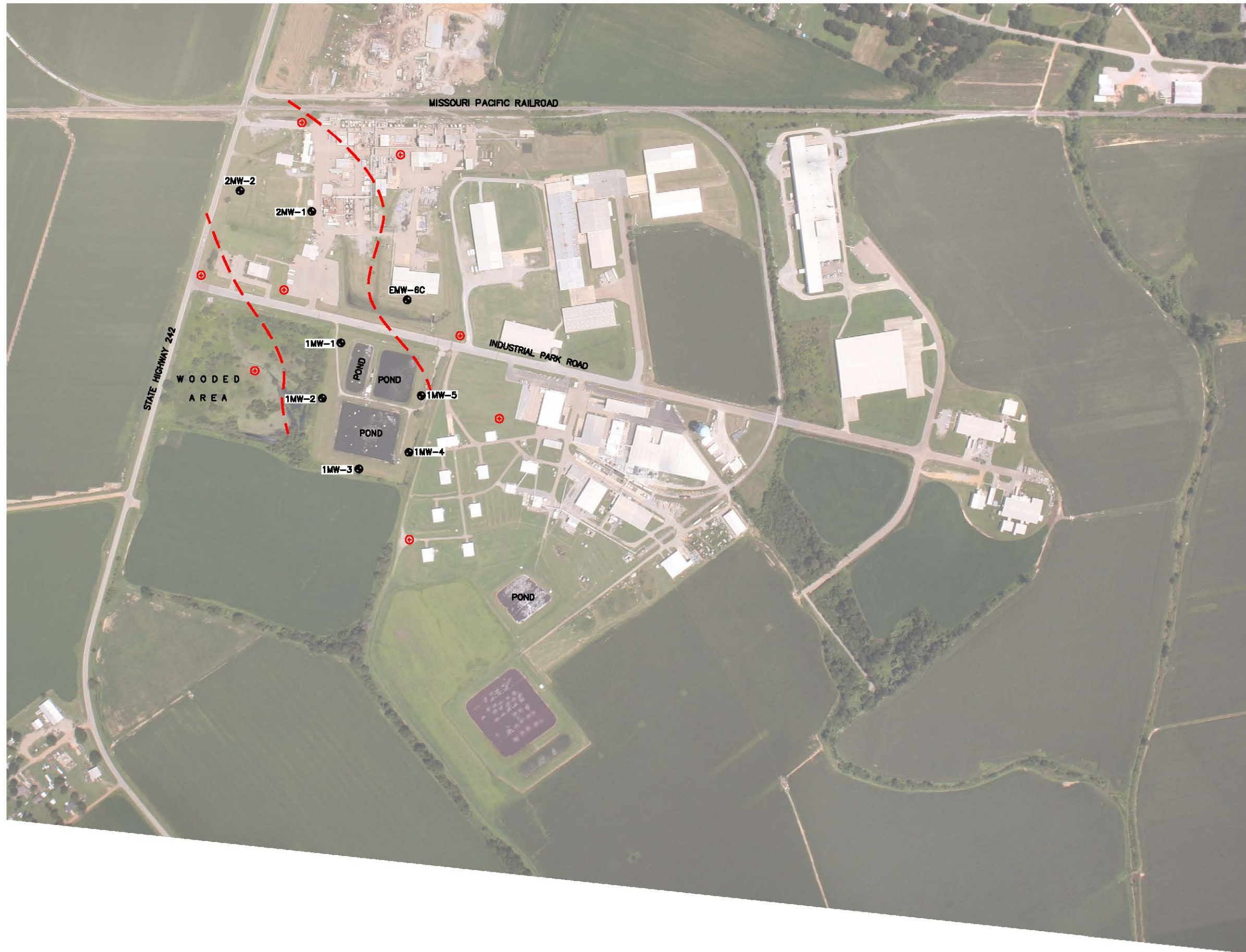
Figure 3

B



B'



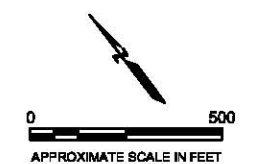


# EXPLANATION

- APPROXIMATE PERCHED ZONE EXTENT
- PERCHED ZONE MONITORING WELL
- PROPOSED PERCHED ZONE MONITORING WELL LOCATION

NOTE:  
ALL PROPOSED WELL AND BORING LOCATIONS ARE APPROXIMATE, AND MAY BE ADJUSTED BASED ON UTILITIES, FIELD ACCESS, AND OTHER CONDITIONS.

# FINAL



BASE MAP MODIFIED FROM:  
EnSafe, 1996-Phase III FI, 2001 Groundwater Monitoring Report,  
Drawings C2162GWS and C2162VC7

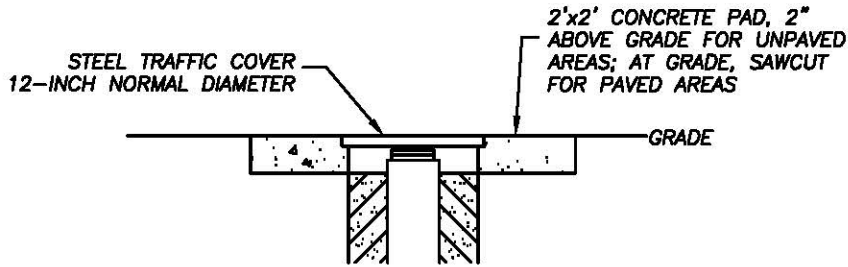
PERCHED ZONE WELL LOCATIONS

Cedar Chemical  
Helena-West Helena, Arkansas

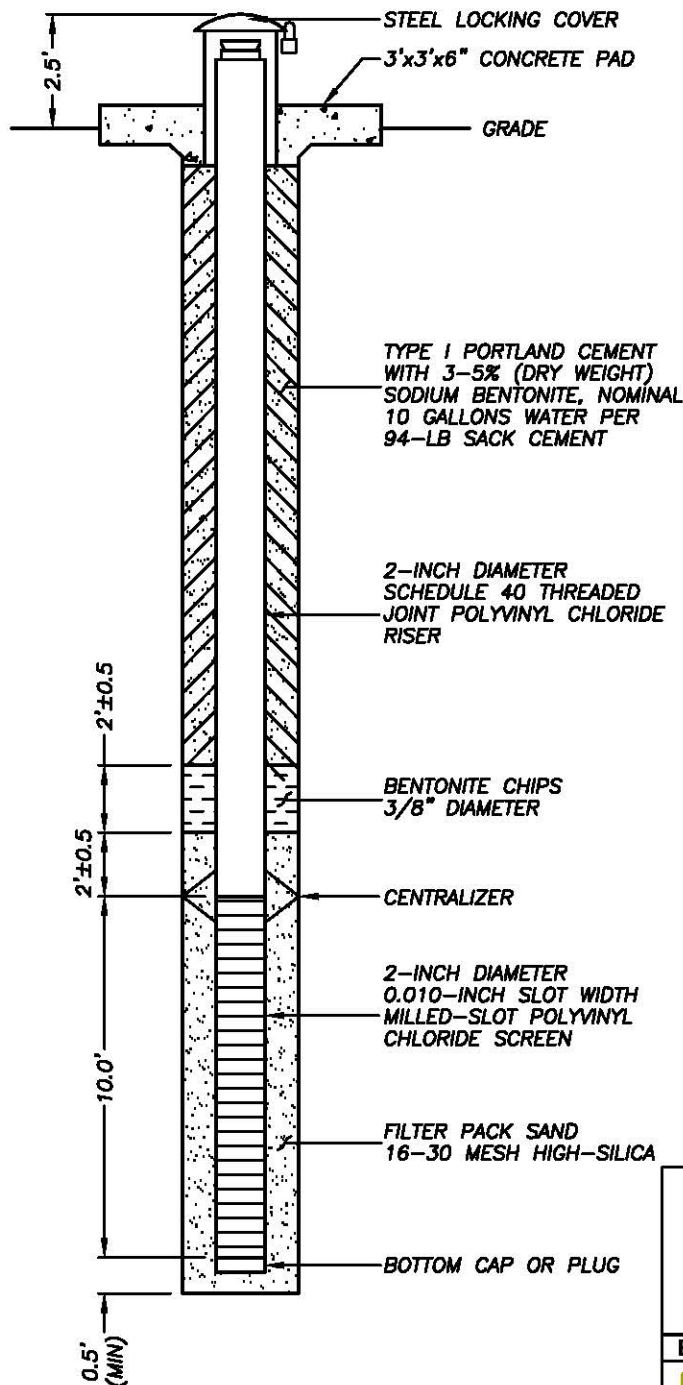
By: HCS Date: 1/15/08 Project No. 13636



Figure 5



### ALTERNATE SURFACE COMPLETION



TYPICAL PERCHED ZONE MONITORING  
WELL CONSTRUCTION  
Cedar Chemical  
Helena-West Helena, Arkansas

By: HCS

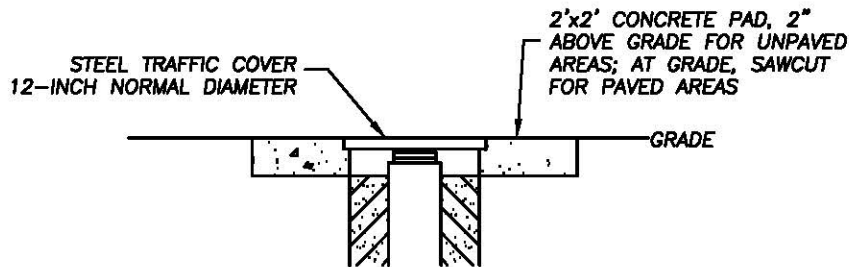
Date: 1/15/08

Project No. 13636

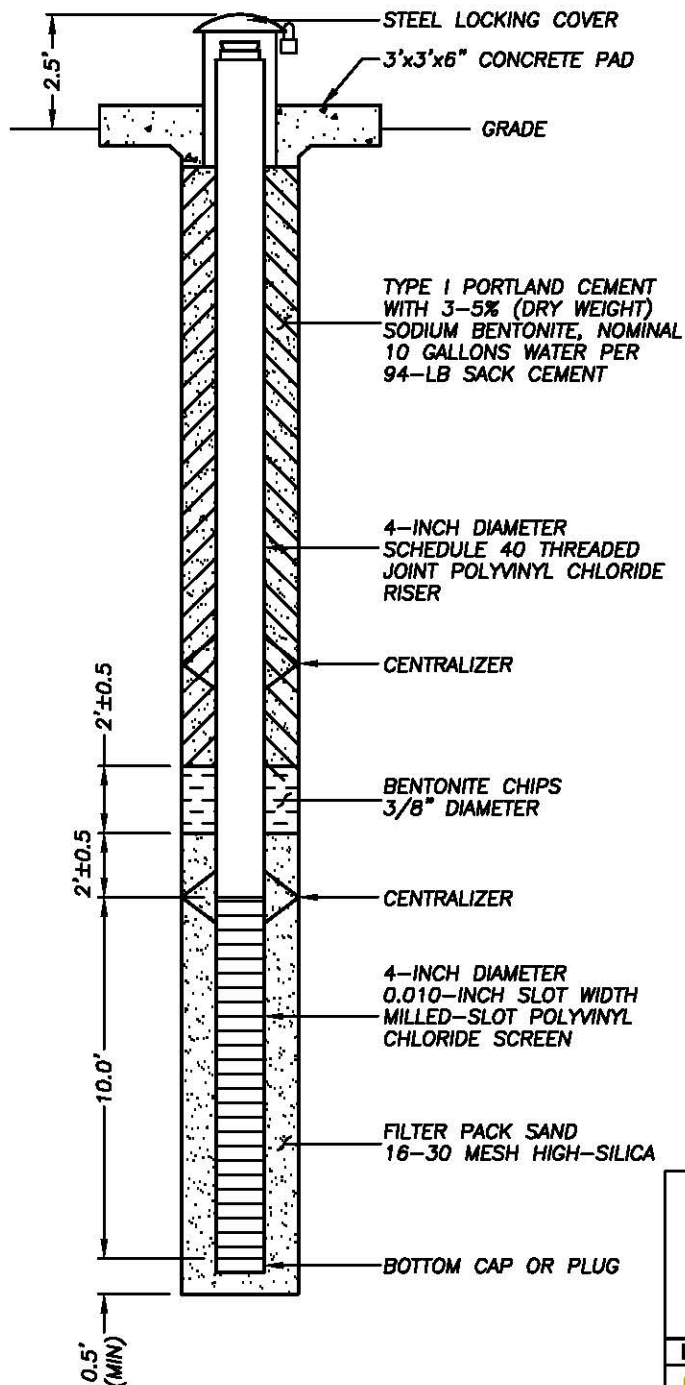


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Figure 6



### ALTERNATE SURFACE COMPLETION



NOTE:  
CENTRALIZERS WILL BE PLACED  
EVERY 40 FEET FROM TOP OF  
SCREEN TO SURFACE.

TYPICAL ALLUVIAL AQUIFER  
MONITORING WELL CONSTRUCTION  
Cedar Chemical  
Helena-West Helena, Arkansas

By: HCS Date: 1/15/08 Project No. 13636



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Figure 7



**EXPLANATION**

- DEEP MONITORING WELL (LOWER ALLUVIUM)
- SHALLOW MONITORING WELL (UPPER ALLUVIUM)
- PERCHED ZONE MONITORING WELL
- AGRICULTURAL IRRIGATION WELL
- ⊕ PROPOSED CPT LOCATION

WELLS NOT SHOWN DUE TO UNKNOWN LOCATIONS:

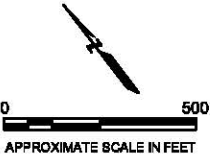
- AGI-2
- AGI-3
- AGI-4
- AGI-6
- AGI-7

APPROXIMATE LOCATION OF WELL COVERED BY ASPHALT:

- 4MW-2

NOTE:  
ALL PROPOSED WELL AND BORING LOCATIONS ARE APPROXIMATE, AND MAY BE ADJUSTED BASED ON UTILITIES, FIELD ACCESS, AND OTHER CONDITIONS.

**FINAL**



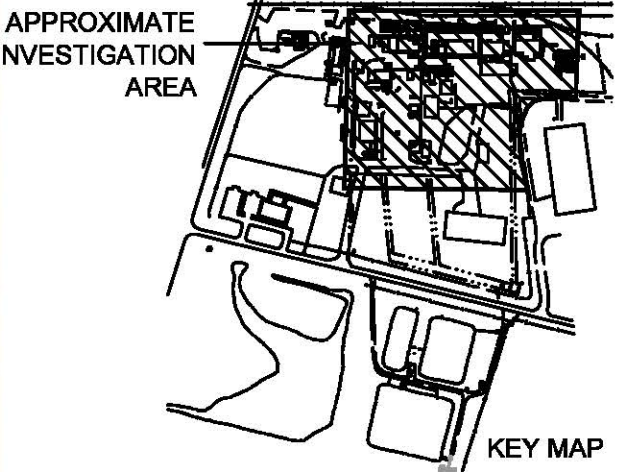
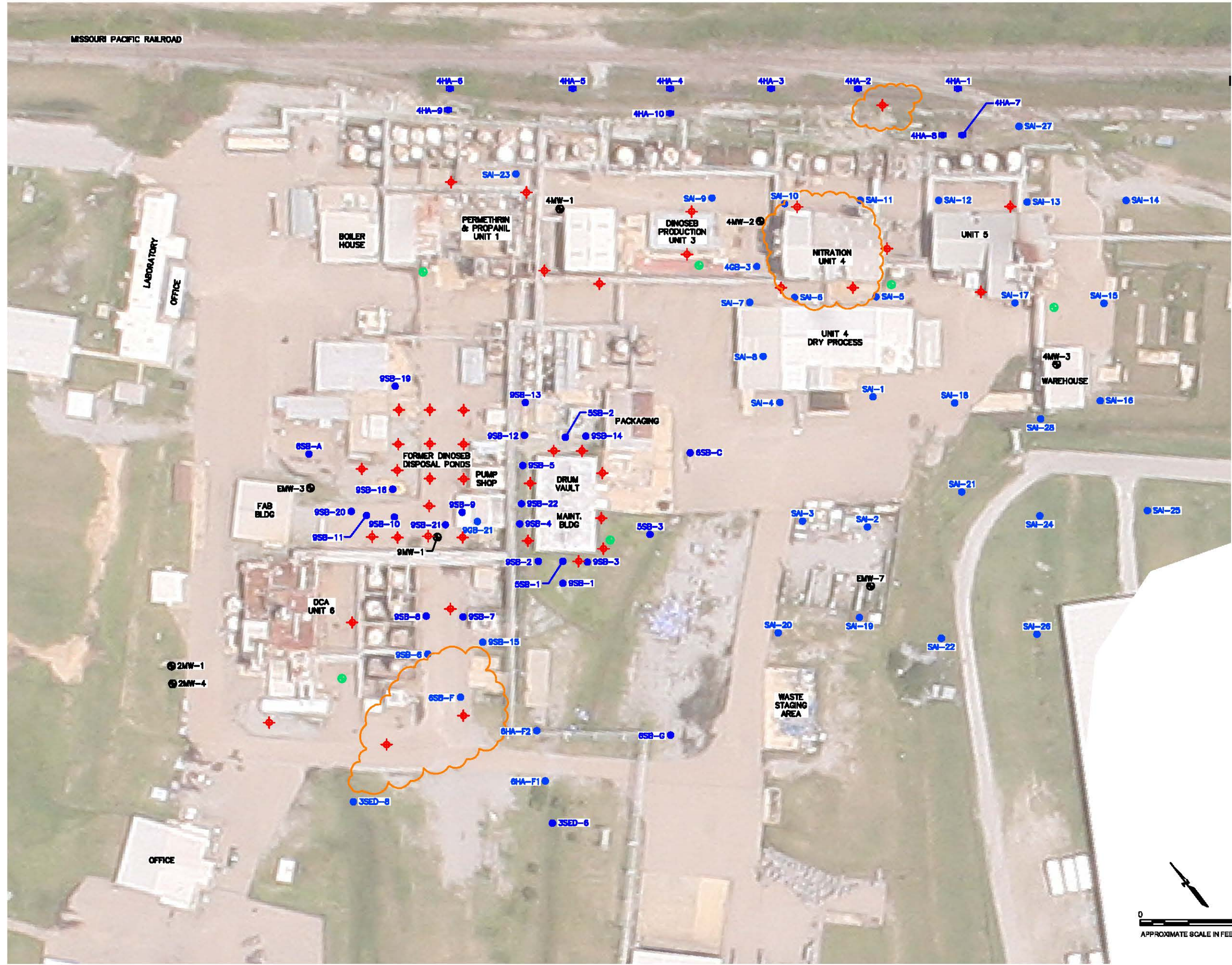
BASE MAP MODIFIED FROM:  
EnSafe, 1996-Phase III FI, 2001 Groundwater Monitoring Report,  
& December 2007 Site Reconnaissance  
Drawings C2162GWS and C2162VC7

CPT BORING LOCATIONS  
Cedar Chemical  
Helena-West Helena, Arkansas

By: HCS Date: 1/15/08 Project No. 13636



Figure 8



- LEGEND**
- EXISTING MONITORING WELL LOCATION
  - PROPOSED MONITORING WELL LOCATION
  - EXISTING SOIL SAMPLE LOCATION
  - ◆ PROPOSED DPT LOCATION
  - EXISTING HAND AUGER BORING
  - ☁ SUSPECT WASTE BURIAL AREA IDENTIFIED BY ADEQ

NOTE:  
ALL PROPOSED WELL & BORING  
LOCATIONS ARE APPROXIMATE,  
& MAY BE ADJUSTED BASED ON  
UTILITIES, FIELD ACCESS, &  
OTHER CONDITIONS.

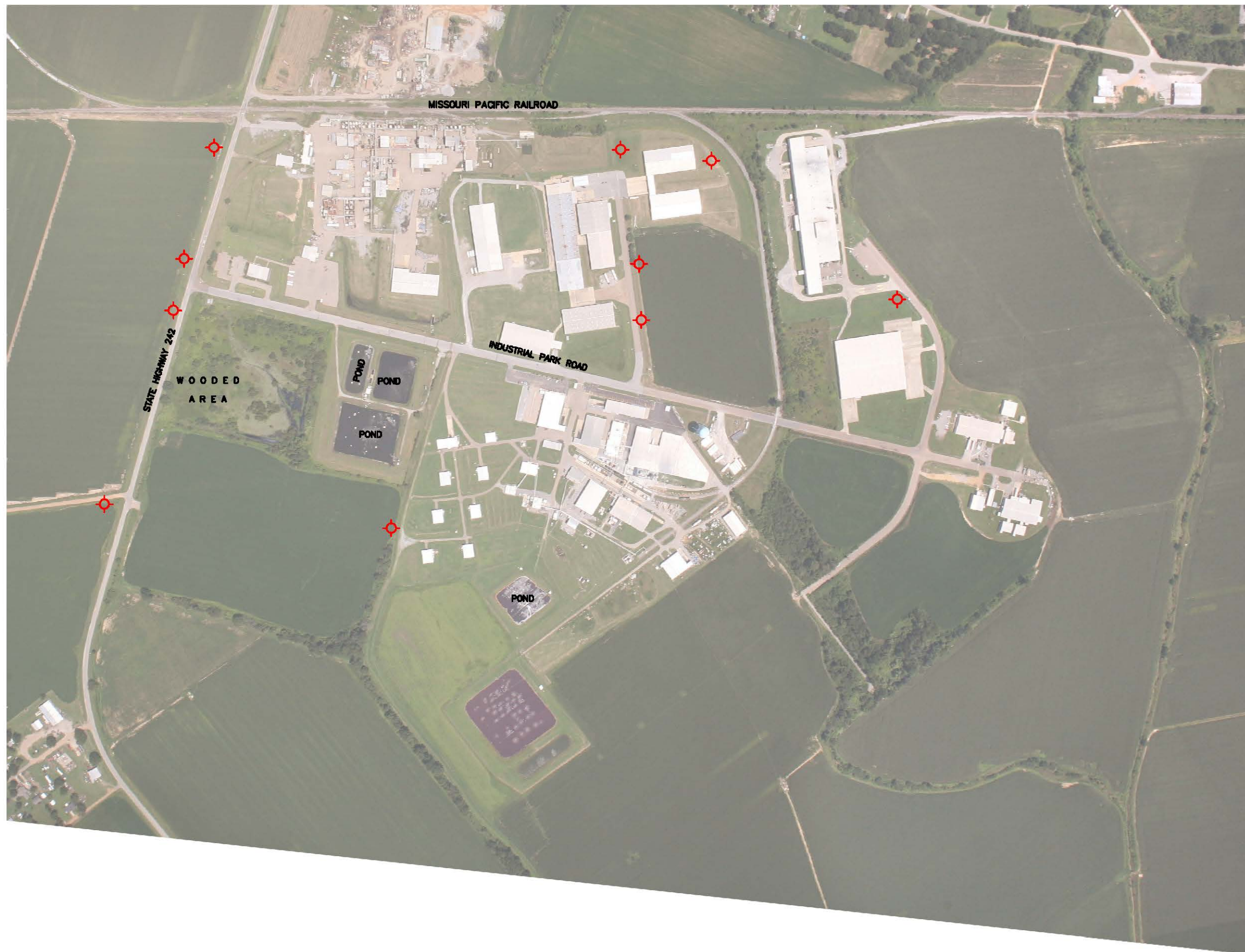
BASEMAP MODIFIED FROM:  
EnSafe, 1996-Phase III FI, 2001 Groundwater Monitoring Report,  
Drawings C2162GWS and C2162VC7

**BORING & WELL LOCATIONS -  
PROCESS AREAS**  
**Cedar Chemical**  
**Helena-West Helena, Arkansas**

By: HCS      Date: 3/18/08      Project No. 13636



Figure 9

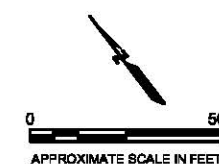


# EXPLANATION

 PROPOSED BACKGROUND DPT LOCATION

NOTE:  
ALL PROPOSED WELL AND BORING LOCATIONS ARE APPROXIMATE, AND MAY BE ADJUSTED BASED ON UTILITIES, FIELD ACCESS, AND OTHER CONDITIONS.

# FINAL



BASE MAP MODIFIED FROM:  
EnSafe, 1996-Phase III FI, 2001 Groundwater Monitoring Report,  
Drawings C2162GWS and C2162VC7

DIRECT PUSH BORING LOCATIONS -  
BACKGROUND SAMPLING  
Cedar Chemical  
Helena-West Helena, Arkansas

By: HCS      Date: 3/10/08      Project No. 13636

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Figure 10